

CLAIMS

1. A transmitter system for transmitting data as a pulsed ultrawide band signal comprising:

a converter for converting a signal to be transmitted from a serial sequence to a parallel sequence;

a modulator to convert said parallel sequence to a parallel stream of impulse trains, each train having a pulse repetition period;

a delay unit to delay said parallel streams of impulse trains by different time intervals within the same pulse repetition period;

a signal combining unit to combine the delayed pulse streams to form a combined signal so that the pulses in the streams occur within the pulse repetition period of a single pulse;

a pulse generator to form a pulse sequence based on said combined signal; and

an antenna for transmitting said pulse sequence.

2. A system according to claim 1, further comprising a spreader coupled to said first converter for receiving said parallel sequence and for spreading said parallel sequence.

3. A system according to claim 1, further comprising a plurality of spreader units, each spreader unit being coupled to said first converter for receiving a parallel sequence and for spreading said parallel sequence.

4. A system according to claim 1 wherein said modulator has an input and an output, said input being connected to said signal combining unit and said output being connected to said antenna.

5. A system according to claim 1 wherein said modulator has an input and an output, said input being connected to said converter and said output being connected to said delay unit.

6. A system according to claim 1 comprising a delay unit for each stream.
7. A system according to claim 2 or 3, further comprising a spread code generator to drive said spreader unit.
8. A receiver system for receiving data as a pulsed ultrawide band signal comprising:
 - a receiving antenna for receiving said pulsed ultrawide band signal, said pulsed signal having a pulse shape, a bandwidth, a pulse width, and a pulse repetition frequency, said pulsed signal comprising two or more interleaved pulse trains having equal pulse repetition periods, said interleaved pulse trains being spaced by a pulse spacing, said pulse repetition period being greater than said pulse spacing;
 - a matched filter coupled to said antenna for filtering said received signal to form a filtered signal, said filter being matched to the pulse shape of said received signal;
 - a low-pass filter coupled to said matched filter to process said filtered signal to form a processed signal;
 - an analogue-to-digital converter coupled to said low-pass filter to convert, at a rate greater than the pulse repetition frequency of said received signal, said processed signal from an analogue signal to a digital signal;
 - a serial-to-parallel conversion unit coupled to said converter to convert said digital signal to produce N parallel sampled signals; and
 - a signal processor coupled to said serial-to-parallel conversion unit to produce an output signal representative of said received data.
9. A system according to claim 8, wherein said receiver matched filter is a sinusoidal waveform.
10. A system according to claim 10, wherein said receiver matched filter is a local oscillator having a centre frequency equal to the inverse of the pulse width.

11. A system according to claim 8, wherein said low-pass filter has a bandwidth substantially equal to the bandwidth of said pulse.
12. A system according to claim 8, further comprising a quadrature mixer coupled between said receiving antenna and said matched filter for separating in-phase and quadrature pulse chains from said received signal.
13. A system according to claim 12, further comprising a plurality of matched filters, and/or analogue-to-digital converters, and/or serial-to-parallel conversion units, each pulse chain having a respective matched filter, and/or analogue-to-digital converter, and/or serial-to-parallel conversion unit.
14. A system according to claim 12, wherein said quadrature mixer is arranged to operate at a frequency substantially equal to the inverse of the pulse width.
15. A system according to claim 8, wherein said signal processor comprises N delay units for receiving said N parallel sampled signals, each of said N delay units being arranged to delay one of said N parallel sampled signals by one or more pulse repetition periods.
16. A system according to claim 15, wherein said N delay units comprise a series of multi-tap delay networks for selecting a predetermined pulse stream from said received pulsed signal.
17. A system according to claim 16, wherein said signal processor further comprises a channel equalizer having an input coupled to one or more outputs of said one or more delay units for equalizing one or more channels in said predetermined pulse stream to form an output signal representative of said received data.

18. A system according to claim 17, wherein said channel equalizer is arranged to apply a recursively square algorithm to said predetermined pulse stream.

19. A system according to claim 15, further comprising a despreader coupled between said one or more delay units and said channel equalizer to despread said delayed signal.

20. A system according to claim 17, wherein said channel equalizer is a pilot-assisted adaptive channel equalizer.

21. A transceiver system comprising a transmitter for transmitting data as a pulsed ultrawide band signal comprising:

- a converter for converting a signal to be transmitted from a serial sequence to a parallel sequence;

- a modulator to convert said parallel sequence to a parallel stream of impulse trains, each train having a pulse repetition period;

- a pulse generator to drive said modulator;

- a delay unit to delay said parallel streams of impulse trains by different time intervals within the same pulse repetition period;

- a signal combining unit to combine the delayed pulse streams to form a combined signal so that the pulses in the streams occur within the pulse repetition period of a single pulse; and

- an antenna for transmitting said combined signal, said transceiver system further comprising:

- a receiver for receiving data as a pulsed ultrawide band signal comprising:

- a receiving antenna for receiving said pulsed ultrawide band signal, said pulsed signal having a pulse shape, a bandwidth, a pulse width, and a pulse repetition frequency, said pulsed signal comprising two or more interleaved pulse trains having equal pulse repetition periods, said interleaved pulse trains being spaced by a pulse spacing, said pulse repetition period being greater than said pulse spacing;

a matched filter coupled to said antenna for filtering said received signal to form a filtered signal, said filter being matched to the pulse shape of said received signal;

a low-pass filter coupled to said matched filter to process said filtered signal to form a processed signal;

an analogue-to-digital converter coupled to said low-pass filter to convert said processed signal from an analogue signal to a digital signal;

a serial-to-parallel conversion unit coupled to said converter to sample said digital signal at a rate greater than the pulse repetition frequency of said received signal and to produce a sampled signal; and

a signal processor coupled to said serial-to-parallel conversion unit to produce an output signal representative of said received data.

22. A DS-CDMA system comprising the transmitter of claim 1.

23. A DS-CDMA system comprising the receiver of claim 8.

24. A DS-CDMA system comprising the transceiver of claim 21.

25. A method for transmitting data as a pulsed ultrawide band signal comprising:

converting in a serial-to-parallel converter a signal to be transmitted from a serial sequence to a parallel sequence;

converting in a modulator said parallel sequence to a parallel stream of impulse trains, each train having a pulse repetition period;

delaying said parallel streams of impulse trains by different time intervals within the same pulse repetition period;

combining the delayed pulse streams to form a combined signal so that the pulses in the streams occur within the pulse repetition period of a single pulse; and

transmitting said combined signal.

26. A method according to claim 25, further comprising spreading in a spreader said parallel sequence after the step of converting said signal to be transmitted from a serial sequence to a parallel sequence.

27. A method according to claim 25, wherein the step of converting in a modulator said parallel sequence is after the steps of delaying said parallel streams and combining the delayed pulse streams.

28. A method according to claim 25, wherein the step of converting in a modulator said parallel sequence is before the steps of delaying said parallel streams and combining the delayed pulse streams.

29. A method for receiving data as a pulsed ultrawide band signal comprising:

receiving said pulsed ultrawide band signal, said pulsed signal having a pulse shape, a bandwidth, a pulse width, and a pulse repetition frequency, said pulsed signal comprising two or more interleaved pulse trains having equal pulse repetition periods, said interleaved pulse trains being spaced by a pulse spacing, said pulse repetition period being greater than said pulse spacing;

filtering in a matched filter said received signal to form a filtered signal, said filter being matched to the pulse shape of said received signal;

processing in a low-pass filter coupled to said matched filter said filtered signal to form a processed signal;

converting said processed signal from an analogue signal to a digital signal;

serial-to-parallel converting said digital signal at a rate greater than the pulse repetition frequency of said received signal and to produce a sampled signal; and

processing said sampled signal to produce an output signal representative of said received data.

30. A method according to claim 29, further comprising separating in-phase and quadrature pulse chains from said received signal.
31. A method according to claim 29, wherein the step of processing the sampled signal comprises delaying said sampled signal by one or more pulse repetition periods.
32. A method according to claim 31, wherein the step of processing the sampled signal further comprises selecting a predetermined pulse stream from said received pulsed signal.
33. A method according to claim 29, wherein the step of processing the sampled signal comprises equalizing one or more channels in said predetermined pulse stream to form an output signal representative of said received data.
34. A method according to claim 33, wherein the step of equalizing comprises applying a recursively square algorithm to said predetermined pulse stream.
35. A method according to claim 29, further comprising despread said delayed signal.